British Heart Journal, 1971, 33, 283–284.

Single-control, accident-proof, manometer tap systems

F. Hepburn
From University Medical Physics Department, General Infirmary, Leeds

The need has already been discussed for the careful design of control tap arrangements used in the clinical investigation of intravascular pressures (Hepburn, 1967). The risk of accidents has been increased by the considerable number of centres introducing such techniques. Because it was considered urgently necessary to reduce these risks, an inexpensive tap system was developed (Hepburn, 1967) using a simple arrangement of standard components. Subsequently the need has been felt for more sophisticated tap systems which are not only simpler in use but which may also be operated in parallel and from a distance.

Several designs of single-tap control have been produced (e.g. Cambridge Instrument Co., Carle Instruments, Honeywell Controls, Labotron, and St. Thomas' Hospital, London). Unfortunately these units are expensive and not in general use. Moreover, though they achieve the functional requirements to varying degrees, it has been felt in this department that they could be improved in safety, simplicity, and convenience. Consequently an eight-position, click-stop, disc-type tap was designed and has recently gained enthusiastic clinical acceptance.

Design of tap system

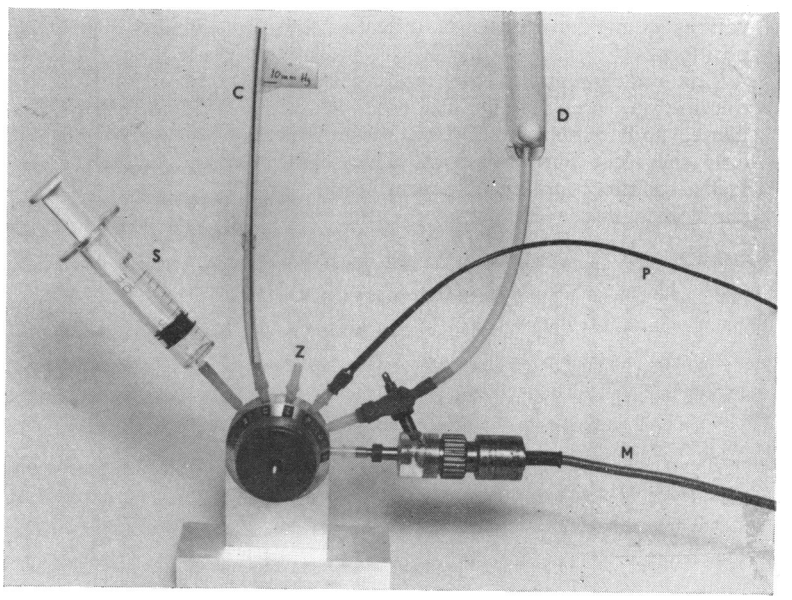
The tap system is illustrated in Fig. 1. It allows the syringe S to be connected successively to the drip supply D, patient-link P, zero pressure Z, and calibration pressure C; it then connects the manometer transducer M in like sequence. Markings on the stator indicate where the attachments are to be made. The connexion in use is immediately apparent by inspection of the correspondence of initials marked on the rotor with those on the stator.

The eight positions allow: (1) preliminary priming of the syringe from the drip supply (S to D); (2) limited syringe flushing of the patient link or blood sampling (S to P); (3) flushing the zero pressure outlet for unambiguous zero reference setting (S to Z); (4) priming of a saline calibration column for standardization of venous recording (S to C); (5) filling of the manometer transducer from the drip supply (M to D) so avoiding damage from overload by careless syringe flushing; (7) subsequent application of zero (M to Z); and (8) calibration (M to C) pressures for setting up the equipment in logical order, while interpolation of (6) the record position (M to P) sites it conveniently for a simple zero and calibration check sequence (6–7–8–6) during the monitoring process.

Convenience and safety

Apart from the need to pass through the 'record' setting to make the initial zero and calibration adjustments in preparation for recording, the successive positions are all in the correct order for the complete assembly

FIG. 1 *Single-channel tap system connected ready for use.*



Received 2 July 1970.

procedure. It has not proved possible to have the convenience of adjacent settings for recording (6) and subsequent flushing of the patient link (2) to remove any traces of diffused blood. However, the syringe flushing technique for sucking out any clot formation and clearing the catheter (i.e. record-withdraw-reprime-flush-record; 6–2–1–2–6) precludes any continuous and unnoticed infusion of saline, or flush back of blood from the patient. It is impossible to connect the patient to the zero or calibration pressures, and potential cause of serious accident is thereby eliminated. Blood sampling is carried out by the same tap sequence and syringe action as for syringe flushing. Any continuing blood flow on removal of the sampling syringe would provide immediate warning that the syringe had not been replaced and the tap reset to the adjacent position (1) in preparation for syringe repriming and flushing of the patient connection. Complete air removal from the tap channels is automatic if an initial back flow from a venous type saline calibration column is allowed to flush the channel and transducer chamber before setting the height of the saline column or replacing it with an arterial calibration signal from a sphygmomanometer if required.

Constructional details and potentialities

The unit can be made in the form of a disc – or the more conventional barrel – tap. The front half of Fig. 2 shows a dismantled and partially disconnected two-channel version of the disc tap. The stator face has connexion points on axially-concentric rings, while the rotor face has surface channels which link various connexion points in different rotor positions.

The attachments to the tap involve no duplication, are radially disposed in one plane, and remain stationary throughout: only the rotor portion moves. This feature facilitates the coupling of several units for simultaneous use in parallel, either by a nearby operator or by remote servo-control (Fig. 2 shows an arrangement for 4 channels). The neat, compact, and stable arrangement, with tap settings in logical order, displayed and equally spaced, results in convenient operation without loss of simplicity for dismantling, cleaning, and reassembly.

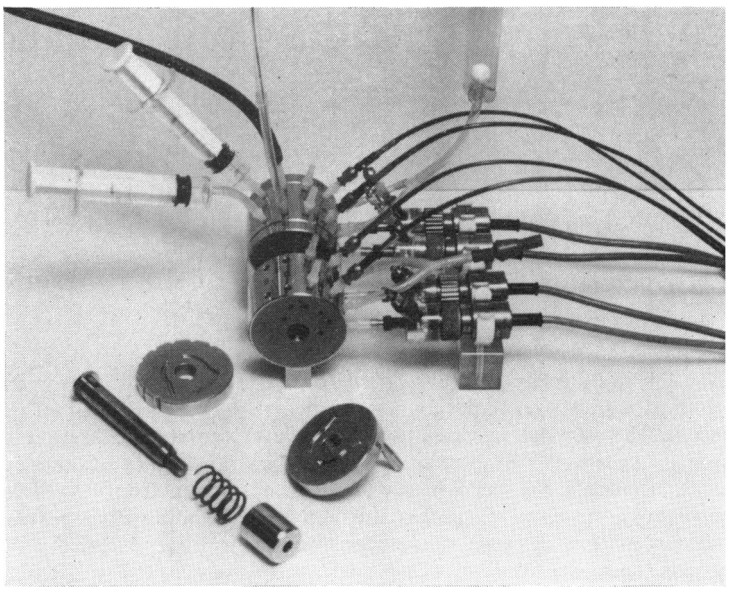


FIG. 2 *Four-channel tap array consisting of a pair of two-channel tap systems that may be coupled for simultaneous use.*

Tap lubrication problems have been solved by micro-coating the working surfaces with a bonded layer of pure polytetrafluoroethylene. This facility was provided by K. and F. Treatments (Plastics) Ltd. of Leeds.

Smaller, two-channel units in medical grade EN58J, stainless steel are now available commercially from Hypodermic Services, Headlands Road, Liversedge, Yorks., U.K.

Reference

Hepburn, F. (1967). Foolproof tap systems for manometry. *Lancet*, 1, 481.